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EU Solvency II - a life perspective

1st IAA Life Colloquium

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”Solvency II will be the crown jewel of the European Union”

Allessandro Iuppa

President, NAIC

Chair, IAIS

at the EU Commission’s public hearing in June 2006

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Contents

- **Background to the EU solvency project**
- A brief presentation of the Solvency II project
- Standard formula for Life insurance

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EU Solvency background

1950-1960s:	early work by **Campagne**, OECD, CEA etc
	Pentikäinen, Finland: equalization reserves – risk theory
1970s:	***compromises***
•	1973: 1st non-life insurance directive
•	1979: 1st life insurance directive
1980s-beginning of 90s:	2nd and 3rd insurance directives:
	introducing ***freedom of services*** with ***home country control*** and the ***single-license*** concept.
	Insurance Accounting Directive, IAD, 1991
	Different work done in e.g. Finland, Norway and UK.

EU Solvency background

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1990s: **Risk-based capital systems introduced in US, Canada, Japan, Australia**

EU:

1994: Insurance Committee discussed a solvency review →

1997: ***Müller report:***

* the system has proved itself

* there is no reason to totally revise it

➔ minor changes in Solvency I (2002)

➔ the Solvency II project

1998: Insurance Groups Directive, IGD

EU Solvency background

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The first decade, 2000: new systems proposed and introduced in, for example, Denmark, the Netherlands, Singapore, Sweden, Switzerland, UK.

IAIS and IAA work on solvency

IASB work on accounting (insurance contracts)

EU – Solvency II:

2000-2003 – phase I: the learning phase

2003-2006 – phase II: the framework directive phase

2007-2010/12 – phase III: ***the implementing phase***

EU Solvency background

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Life approach:

Campagne used the same approach as he did in the 1940s.

As the **risk on investments** is the most important factor for life insurance undertakings and the **technical provisions** (t.p.) is the most important invested amount Campagne suggested as a minimum solvency margin as a percentage of the t.p.

Campagne studied the loss ratio = the loss in a year/technical provisions and assumed it to be distributed according to a Pearson type IV distribution:

With 5% confidence, Campagne proposed

4% of the technical provisions.

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A brief presentation of the Solvency II project

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Lamfalussy procedure – comotology, a four-level approach:

Level 1: The European Commission, COM, adopts a proposal for a framework directive

When parliament and council have agreed, the detailed implementing measures are developed in Level 2

Level 2: Level 2 committee: EIOPC, European Insurance and Occupational Pension Committee

After consulting EIOPC, COM will request advice from Level 3 committee. The advice is prepared in consultation with market participants and submitted to COM.

A formal proposal is made by COM to EIOPC; after a three-month voting procedure, the measures are adopted by COM

A brief presentation of the Solvency II project

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Lamfalussy procedure – comotology, a four-level approach:

Level 3: Level 3 committee: CEIOPS, Committee of European Insurance and Occupational Pensions Supervisors

CEIOPS, works on interpretation of recommendations, guidelines and common standards. They also give advice to the Level 2 committee and have consultations with the market stakeholders (insurance industry, actuaries, CFOs, CROs etc)

Level 4: COM checks the member states' compliance with the EU legislation and may take legal action.

A brief presentation of the Solvency II project

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- ***2000-2003 – phase I: the learning phase***

  KPMG-report, different studies made giving a platform for further work

- ***2003-2007 June – phase II: the framework directive phase***

  3 waves of Calls for Advice giving structure for the framework directive; QIS 1 -3 to test valuation and model proposals for the framework

- ***2007-2012/13 – phase III: the implementing phase***

  modeling, standard formula, "guidance for internal models", calibration of models and parameters. Implementing in national law.

The political landscape in Europe: the Solvency II work

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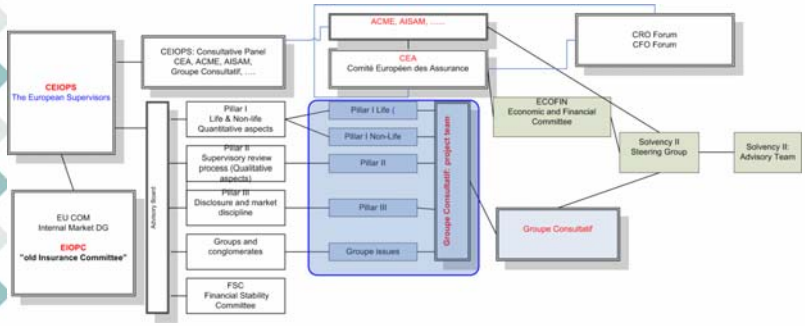

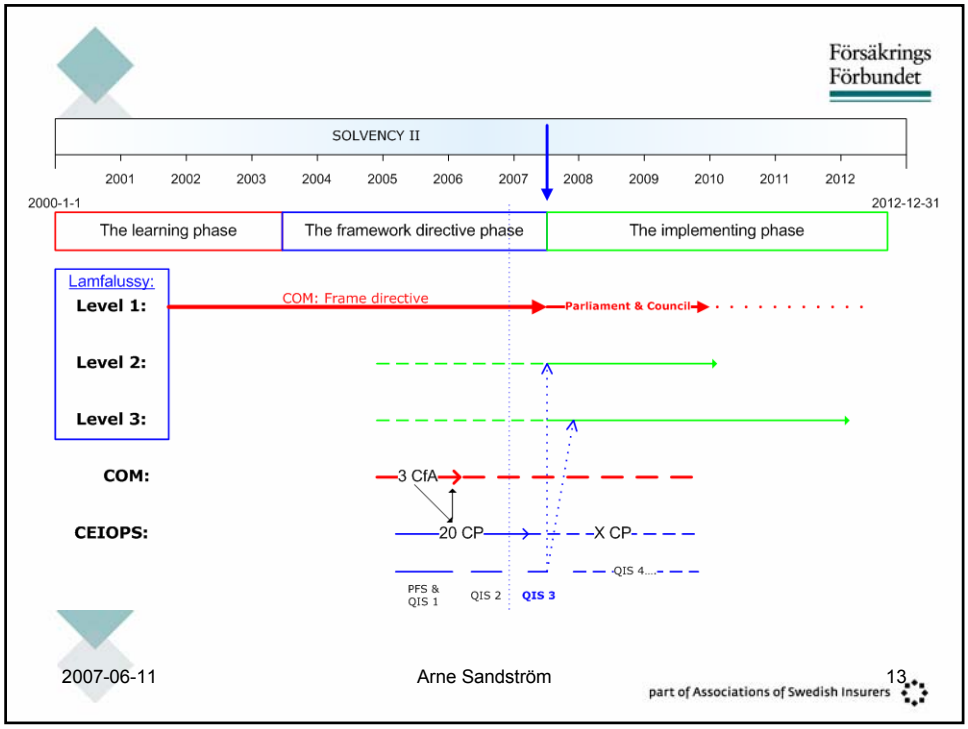
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SOLVENCY II
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2000-1-1
2012-12-31
The learning phase
The framework directive phase
The implementing phase
Lamfalussy:
Level 1:
Level 2:
Level 3:
COM:
CEIOPS:
COM: Frame directive
Parliament & Council
3 CfA
20 CP
X CP
QIS 4
PFS & QIS 1
QIS 2
QIS 3
2007-06-11
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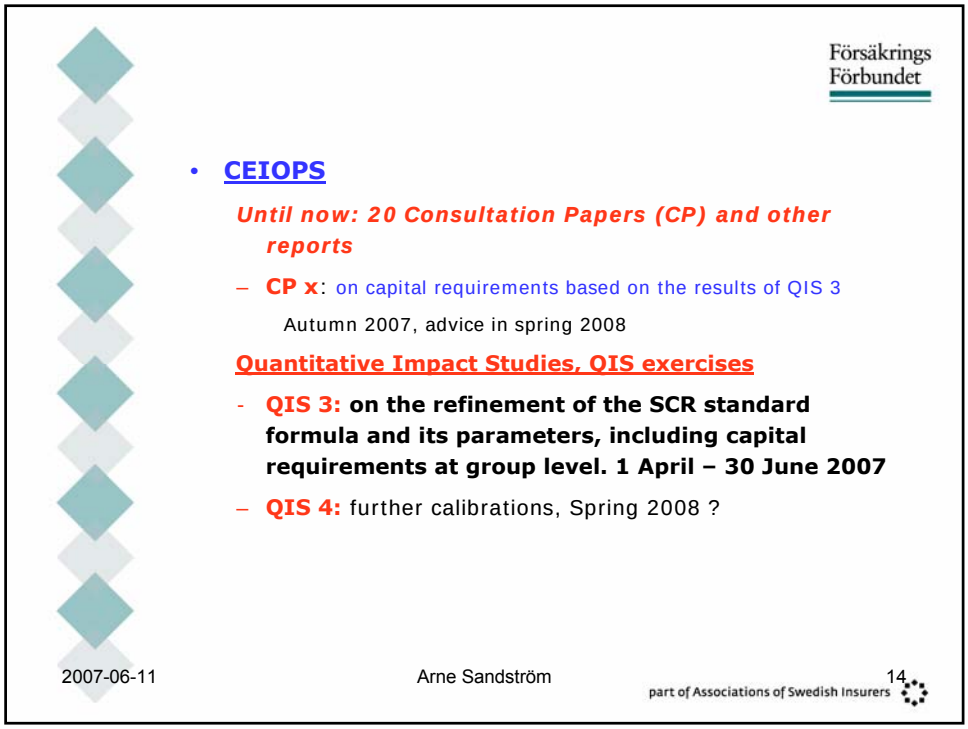
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• CEIOPS
Until now: 20 Consultation Papers (CP) and other reports
– CP x: on capital requirements based on the results of QIS 3
Autumn 2007, advice in spring 2008
Quantitative Impact Studies, QIS exercises
- QIS 3: on the refinement of the SCR standard formula and its parameters, including capital requirements at group level. 1 April – 30 June 2007
– QIS 4: further calibrations, Spring 2008 ?
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A brief presentation of the Solvency II project

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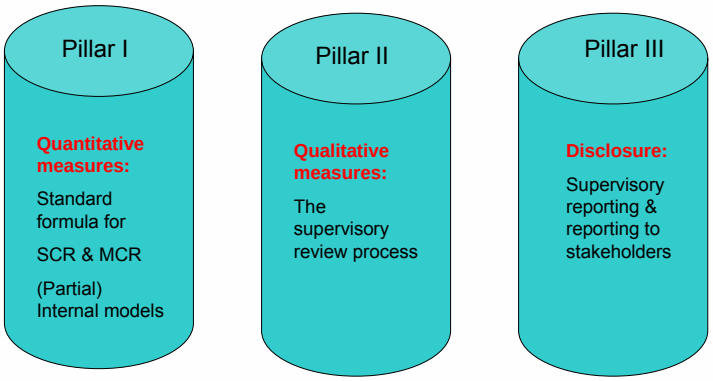
Three pillar approach – similar to Basel II



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Two main building blocks in Solvency II

- The valuation of assets & technical liabilities
- The determination of capital requirements

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Capital: Investments and eligible capital

Prudent person rule

"No arbitrary restrictions on investments"

Available capital ➔ **Own funds**

- Own funds = Basic own funds + Ancillary own funds
  - Basic own funds: On balance sheet items
  - Ancillary own funds: Off balance sheet items

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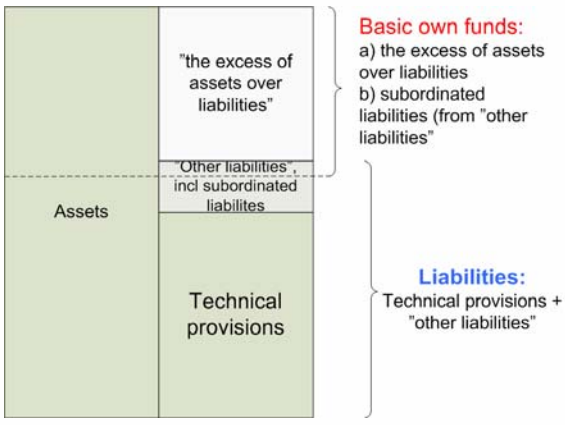
Basic own funds



Classification of own funds

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Quality of items		Balance Sheet (BS)		
Good	Not Good	On BS	Off BS	➔ Tier
√		√		1
√			√	2
	√	√		
	√		√	3
	√ (poor)	√		

Valuation

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- **Valuation** *at the amount for which*

Assets could be exchanged
Liabilities could be transferred, or settled

} between knowledgeable willing parties in an arm's length transaction

"Liabilities" = technical provisions + "other liabilities"

- **Technical provision** *calculated on a current exit[1] value basis*

Hedgeable risks: market consistent valuation

Non-hedgeable risks: Best estimate[2] + Risk margin (Cost-of-capital)

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1) "cost of fulfilling obligations" (IASB)

2) In IAA and IAIS terminology: Current estimate

Valuation of assets and technical provisions

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Hedging: "activities designed to reduce the risks imposed by other activities"

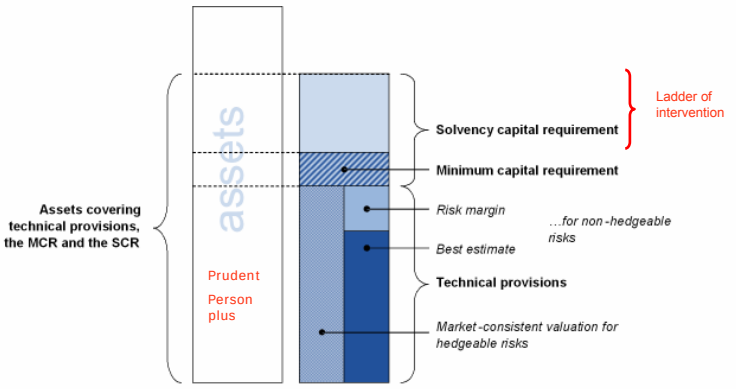

Figure (Source: CP 20, p. 9)
2.2 Pillar 1 is made up of a number of different elements that, in combination, should provide a structured means of assessing whether the insurer has adequate financial resources for the risk it carries.

Pillar I: main issues

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- **The target: Solvency Capital Requirement, SCR**
- **The ultimate: Minimum Capital Requirement, MCR**
  - Also an absolute floor in million euros (AMCR)

"a range of supervisory interventions" – ladder

MCR –minimum capital requirement

- QIS 3: a ”simplified” modular approach with an absolute floor (AMCR)
- The European insurance industry wants to have a “compact approach” tested, i.e. a percentage of SCR: MCR = x%SCR (for transitional arrangements the following information should be disclosed: MCR = (1/3)*SCR

Other issues

- Pillar I: Group solvency
- Pillar II: A robust system of governance
- Pillar II: Fit & proper requirements on persons
- Pillar II: A risk management system
- Pillar II: Own risk and solvency assessment (ORSA)
- Pillar II: Actuarial function
- Pillar III: Disclosure (IASB/IFRS)

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Pillar I: SCR

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SCR - Standard formula

– a **modular approach**

– **risk modules**, at least:

- Non-life underwriting risk
- Life underwriting risk
- Health underwriting risk (special)
- Market risk
- Credit risk (incl spread and counterparty default risk)
- Operational risk

– **risk charges**: factor based or stress tested

Standard formula - a modular approach

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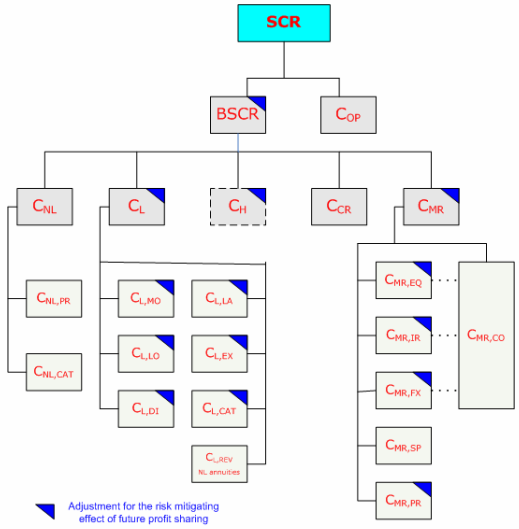

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Pillar I: SCR – standard formula based on QIS 3

$$SCR = BSCR + C_{OP}$$

- *BSCR* = Basic SCR
- C_{OP} = Operational risk

Pillar I: SCR

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– **risk measure**: VaR

but possible to use other measures such as TailVaR in Internal Models

– **confidence level**: 99,5% using VaR

– **time horizon** of the solvency assessment:

a time horizon of one year for the capital requirement

– **aggregation**: linear correlation ("tail correlation")

$$BSCR^2 = \sum_i \sum_j \rho_{ij} C_i^2 C_j^2$$

Pillar I: SCR

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- **The calibration** for the standard formula
  - Correlations and other parameters to be set within each module
    - → *set at Level 2* (results of the QIS 3, …)
  - Overall calibrations: the **same approach** (risk measure, confidence and time horizon) for each risk module as for SCR
    - → Calibration problems?
- The treatment of **risk mitigation** instruments
  - include both traditional and non-traditional risk transfer instruments on the asset side (e.g. financial hedging) and on the liability side (e.g. hedging instruments, reinsurance).

Pillar I: SCR
Standard formula→ Internal model

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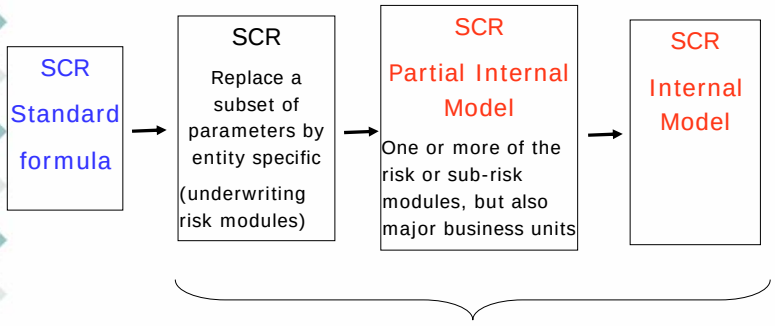

needs approval by the supervisory authority

Internal models:

- Use test
- Statistical quality standards

Operational risk; C_{OP}

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$$C_{OP} = \min\left\{0.30 \cdot BSCR; \max\left[0.03Earn_L + 0.02Earn_{NL}; 0.003TP_L + 0.02TP_{NL}\right]\right\}$$

(OP_{load}: a pre-specified coefficient; 0.30)

BSCR: Basic SCR

TP: Total technical provisions, gross of reinsurance

Earn: Total earned premiums, gross of reinsurance

Pillar I: SCR – standard formula for life undertakings

$$BSCR = \sqrt{\sum_i \sum_j \rho_{ij} C_i C_j} + RPS$$

Reduction for profit sharing

Correlations	MR	CR	L	NL
MR	1	0.25	0.25	0.25
CR		1	0.25	0.5
L			1	0
NL				1

Life underwriting risk: C_L – stress tested

$$C_L = \sqrt{\sum_i \sum_j \rho_{ij} C_{L,i} C_{L,j}}$$

Sub-risks:

- Mortality
- Longevity
- Disability
- Expense
- Lapse
- Revision
- CAT

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L: correlation structure

Correlations Market Risk	MO Mortality	LO Longevity	DI Disability	LA Lapse	EX Expense	RE Revision (NL annuities)	CAT Cata-strophe
MO	1	0	0.5	0	0.25	0	0
LO		1	0	0.25	0.25	0.25	0
DI			1	0	0.5	0	0
LA				1	0.5	0	0
EX					1	0.25	0
RE						1	0
CAT							1

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Life: Mortality – Longevity - Disability $C_{L,\circ}$

$$C_{L,\circ} = \sum_i (\Delta NAV_i \mid Shock)$$

ΔNAV_i: the change in net value of assets minus liabilities due to shock; the subscript I denotes each policy where the payment of benefits (either lump sum or multiple payments) is contingent on mortality risk

Shock:

Mortality shock: a permanent 10% increase in mortality rates for each age

Longevity shock: a permanent 25% decrease in mortality rates for each age

Disability shock: an increase of 35% in disability rates for the next year, together with a permanent 25% increase over the best estimate in disability rates at each age in the following years

Life: lapse $C_{L,LA}$

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$$C_{L,LA} = \sum_i (\Delta NAV_i \mid Shock)$$

ΔNAV_i: the change in net value of assets minus liabilities due to lapse shock (the sum is taken over all policies):

Lapse Shock: the greater of

(1) A 50% increase in the assumed rates of lapsation each year

(2) An increase in absolute terms of 3% per annum in the assumed rate of lapsation, for policies where the surrender value currently exceeds the technical provisions held: together with a 50% reduction in the assumed rates of lapsation for policies where the surrender value is currently less than the technical provisions held

Life: expense $C_{L,EX}$

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$$C_{L,EX} = (\Delta NAV \mid Shock)$$

ΔNAV: the change in net value of assets minus liabilities due to expense shock

Expense shock:

All future expenses are higher than best estimate anticipations by 10%, and the rate of expense inflation is 1% per annum higher than anticipated;

But for policies with adjustable loadings, 75% of these additional expenses can be recovered from year 2 onwards through increasing the charges payable by policyholders.

Life: revision $C_{L,RE}$

$$C_{L,RE} = (\Delta NAV \mid Shock)$$

ΔNAV: the change in net value of assets minus liabilities due to revision shock

Revision shock:

A 3% increase in the annual amount payable for annuities exposed to revision risk. The impact should be assessed considering the remaining run-off period.

*This risk should be applied to the only to annuities arising from **non-life claims** that are allocated to the C_L module.*

Life: catastrophe $C_{L,CAT}$

$$C_{L,CAT}^2 = Life_{MO+DI,CAT}^2 + Life_{LA,CAT}^2 = \left(0.0015\sum_i Capital\_at\_Risk_i\right)^2 + \left(0.75 \cdot Surrender\_strain\_linked\right)^2 =$$

$$= \left(0.0015\sum_i \left(SA_i + AB_i \cdot Af_i - TP_i\right)\right)^2 + \left(0.75 \cdot Surrender\_strain\_linked\right)^2$$

Capital_at_Risk$_i$: the subscript I denotes each policy where the payment of benefits (either lump sum or multiple payments) is contingent on either mortality or disability.

AB: where benefits are payable as a single lump sum, the annualised amount of benefit payable on disability; otherwise zero (for each policy)

SA: where benefits are not payable as a single lump sum, the sum assured on disability; otherwise zero (for each policy)

Af: average annuity factor

TP: the (net of reinsurance) technical provisions (for each policy)

Surrender_strain_linked: the sum of the differences (where positive) between (a) the amount currently payable on surrender and (b) the technical provisions held.

Market risk: C_{MR} – stress tested

$$C_{MR} = \sqrt{\sum_i \sum_j \rho_{ij} C_{MR,i} C_{MR,j}}$$

Sub-risks:

- Equity
- Interest rate
- Currency
- Credit spread
- Property
- Concentration

MR: correlation structure

Correlations Market Risk	EQ equity	IR interest rate	FX currency	SP credit spread	PR Property	CO Concen-tration
EQ	1	0.5	0.25	0.25	0.75	0
IR		1	0.25	0.25	0.5	0
FX			1	0.25	0.25	0
SP				1	0.25	0
PR					1	0
CO						1

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Market risk, Equities: $C_{MR,EQ}$

$$C_{MR,EQ}^2 = C_{EQ,G}^2 + C_{EQ,O}^2 + 2 \cdot 0.75 \cdot C_{EQ,G} C_{EQ,O}$$

$$C_{EQ,i} = \max\left\{\Delta NAV_{EQ,i}; 0\right\}$$

Two markets: Global (i=1), Other (i=2)

$\Delta NAV_{EQ,1}$= a change in the net value of assets minus liabilities due to a 32% fall in index 1, Global market

$\Delta NAV_{EQ,2}$= a change in the net value of assets minus liabilities due to a 45% fall in index 2, Other market

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Market risk, Interest rate: $C_{MR,IR}$

$$C_{MR,IR} = \max\left\{0; \Delta NAV_{UP}; \Delta NAV_{DOWN}\right\}$$

ΔNAV: changes in net value of assets and liabilities due to re-valuing all interest rate sensitive instruments using altered term structures

UP: upward shock

DOWN: downward shock

The altered term structures are derived by multiplying the current interest rate curv by $(1+s_{UP})$ and $(1+s_{DOWN})$, where both stresses are constant over five maturity buckets:

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Maturity t (years)	1	2	3	4	5	6	7
Relative changes $s_{up}(t)$	0.94	0.77	0.69	0.62	0.56	0.52	0.49
Relative changes $s_{down}(t)$	-0.51	-0.47	-0.44	-0.42	-0.40	-0.38	-0.37

Maturity t (years)	8	9	10	11	12	13	14
Relative changes $s_{up}(t)$	0.46	0.44	0.42	0.42	0.42	0.42	0.42
Relative changes $s_{down}(t)$	-0.35	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34

Maturity t (years)	15	16	17	18	19	20+
Relative changes $s_{up}(t)$	0.42	0.41	0.40	0.39	0.38	0.37
Relative changes $s_{down}(t)$	-0.34	-0.33	-0.33	-0.32	-0.31	-0.31

Exemple: an upward stress for a five-year interest rate is $R_1(5) = R_0(5) \bullet (1+0.56)$, where $R_0(5)$ is the interest rate based on the current term structure

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Market risk, Currency: $C_{MR,FX}$

$$C_{MR,FX} = \Delta NAV_{FX}$$

ΔNAV: immediate effect on net value of assets and liabilities due to **a 20% change** (rise or fall) in value of all other currencies against local currency

Market risk, Property: $C_{MR,PR}$

$$C_{MR,PR} = \Delta NAV_{PR}$$

ΔNAV: immediate effect on net value of assets and liabilities due to **a 20% fall** in real estate benchmarks (direct or indirect exposures)

Market risk, Spread: $C_{MR,SP}$

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$$C_{MR,SP} = \sum_i EAD_i \cdot m(D_i) \cdot f(rating_i)$$

EAD: Exposure at default; the credit risk exposure as determined by reference to market values

D: the effective duration of credit risk exposure

f: a function of the rating class of the credit risk exposure (calibrated to deliver a shock consistent with VaR 99.5%)

m(•): a function of the duration of the credit exposure

Rating	AAA	AA	A	BBB	BB	B	CCC	NR
f(rating)	0.25%	0.25%	1.03%	1.25%	3.39%	5.60%	11.20%	2.00%

$m(D_i) = \min\{D_i;8\}$ if rating = BB or unrated

$\min\{D_i;6\}$ if rating = B

$\min\{D_i;4\}$ if rating = CCC

D_i, otherise

Market risk, Concentration: $C_{MR,CO}$

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$$C^2_{MR,CO} = \sum_i C^2_{CO,i}$$

$$C_{CO,i} = \max\{0; E_i - CT \cdot A\} \cdot \left(g_0 + g_1 \cdot \max\{0; E_i - CT \cdot A\}\right)$$

E: the net exposure to a single counterparty (sum of the exposures across asset classes)

CT: concentration threshold

A: the amount of total assets excluding those where the policyholders bears the investment risk

g_0 and g_1: parameters, depending on the rating of the counterparty

rating	CT	Credit Quality step	g_0	g_1
AAA-AA	5%	1	0.1840	0.0401
A	5%	2	0.2684	-0.0163
BBB	3%	3	0.3862	-0.0416
BB or lower	3%	4-6, -	0.9227	-0.4314

Credit risk, Counterparty default: C_{CR}

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$$C_{CR}^2 = \sum_i Def_i = \sum_i RC_i \cdot N\left[\sqrt{\frac{1}{1-R}} \cdot G(PD_i) + \sqrt{\frac{R}{1-R}} \cdot G(0.995)\right]$$

Def: The counterparty default risk (either a reinsurance exposure or a financial derivatives exposure)

Def is based on a Vasicek distribution if the implicit correlation is 0.5 (see above)

If the implicit correlation is 1 then Def is determined as RC_i • min{100 PD_i;1}

For an intermediate value of the implicit correlation between 0.5 and 1, Def is interpolated between these two values

RC: the replacement cost of reinsurance or financial derivatives if counterparty defaults

N: the cumulative standard normal distribution function

G: the inverse of the cumulative standard normal distribution function

R: either R_{re} or R_{fd} (reinsurance or financial derivatives)

PD: probability of Default

H: Herfindahl index

$$R_{\circ} = 0.5 + 0.5 \cdot H_{\circ} = 0.5 + 0.5 \cdot \frac{\sum_i RC_i^2}{\left(\sum_i RC_i\right)^2}$$

Rating	AAA	AA	A	BBB	BB	B	CCC- unrated
Credit Q	1		2	3	4	5	6, -
PD_i in %	0.002	0.01	0.05	0.24	1.20	6.04	30.41

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RPS: Reduction for future profit sharing

$$RPS = \min\left\{\left(KC_L^2 + KC_{MR}^2 + 2\rho_{L,MR} KC_L KC_{MR}\right)^{1/2}; FDB\right\}$$

KC_L = The risk mitigating effect of future profit sharing for life underwriting risk

KC_{MR} = The risk mitigating effect of future profit sharing for market risk

FDB = Total amount in technical provisions corresponding to future discretionary benefits

$\rho_{L,MR} = 0.25$ in QIS 2 as for the main risks

RPS: Reduction for future profit sharing

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Life risk: $KC_L^2 = \sum_i \sum_j \rho_{ij} KC_{L,i} KC_{L,j}$

Market risk: $KC_{MR}^2 = \sum_i \sum_j \rho_{ij} KC_{MR,i} KC_{MR,j}$

RPS: Reduction for future profit sharing

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Life & Market risk:

The risk mitigating effect KC_x of future profit sharing is determined as follows:

1) The stress (shock) test should be calculated under the condition that the assumptions on future bonus rates remain unchanged before and after the shocks being tested ($C_{L,x}$ & $C_{MR,x}$)
2) The results of the scenarios should also be determined under the condition that the undertaking is able to vary its assumptions on future bonus rates in response to the shock being tested $(C_{L,x}^* \& C_{MR,x}^*)$
3) $KC_{L,x} = C_{L,x} - C_{L,x}^*$

$KC_{MR,x} = C_{MR,x} - C_{MR,x}^*$

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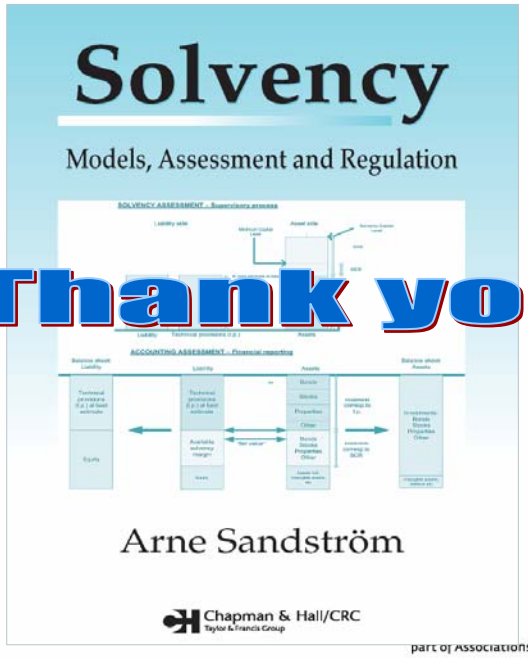

Thank you